EXAMINED.

WINTERING BEES IN CELLARS

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RESULTS from wintering bees in a cellar are excellent when conditions in the cellar are such as to keep the bees from wearing themselves out by excessive activity. Cellar wintering is practicable where the average outdoor temperature during the winter months is as low as 25° F. A map is given (p. 3) so that the beekeeper may know whether this method is advisable in his locality.

The cellar should be arranged so that the ceiling is below the frost line, and so that the ceiling and side walls are thoroughly protected at all points. The cellar should be kept so that the lowest temperature within the hives is at least 52° F. At this temperature there will be little need of special ventilating arrangements. There should be no condensation of moisture within the hives, and the cellar should be well drained.

Bees should be put into the cellar after a good flight in late November, or earlier in the more northern localities. They should be removed when fresh pollen and nectar are available, usually about the last of March.

Soon after the hives are placed on their summer stands, each colony should be given additional stores and room for the development of a large quantity of brood.

It is important that none of the factors of good wintering be omitted. Several tests are given in this bulletin so that the beekeeper may determine whether his cellar is a satisfactory place for wintering bees.

WINTERING BEES IN CELLARS.

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CELLAR WINTERING VERSUS OUTDOOR WINTERING.

BEES in the more northern parts of the United States for many years have been placed by some of the best beekeepers in cellars or special repositories during the coldest parts of the winter. There has been a growing feeling, however, that if outdoor wintering is practicable, in most cases it gives better results, and there has been a decided change from cellar wintering to outdoor wintering within the past decade. The difficulty seems to be that the methods of cellar wintering practiced have not been satisfactory and it seems probable that if as much attention had been given to the perfection of the methods of cellar wintering as has been given to an improvement of the methods of outdoor wintering, there would not have been as great a change to the outdoor methods as has taken place.

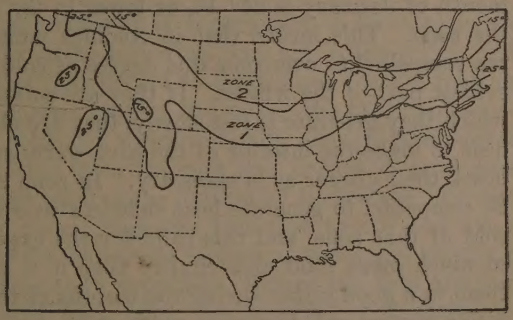

FIG. 1.—Map of the United States showing regions where cellar wintering is practicable, based on the average temperature of January. From data furnished by the United States Weather Bureau.

The placing of bees in a cellar is only another way of putting insulation about the hives, the only difference being that in the cellar all of the hives are protected alike and the protection is placed about the apiary instead of around hives in groups or singly. It follows that the principles which apply to successful outdoor wintering

apply equally to the protection of the bees in the cellar. It is urged, therefore, that before attempting to winter bees in the cellar, the beekeeper study the bulletins[1] of the department in which these principles are set forth.

WHERE IS CELLAR WINTERING ADVISABLE?

Before deciding whether or not the bees are to be wintered in a cellar, several factors should be considered, the chief of these being (1) the winter climate, (2) the kind of winter stores, and (3) the location of the apiary as regards wind protection.

WINTER CLIMATE.

In any locality where the average temperature of the winter months falls below 25° F. (zone 1) cellar wintering may be practiced with profit, and in localities where the average temperature of these months falls as low as 15° F. (zone 2) cellar wintering is much to be preferred. Figure 1 shows the boundaries of these zones for the United States for the month of January, which may be taken as typical of the winter months. It will be noted that these zones do not follow parallels of latitude. As was pointed out in the bulletin of the department on outdoor wintering,[2] it is quite possible to protect bees in zone 1 sufficiently to winter them outdoors, but if a proper cellar is provided, if conditions within the cellar are correct, and if the stores are good and the colonies are strong, just as good results may be obtained from cellar wintering.

In zone 1 the average temperature of the outside air during the month of January is 25° F., or lower in the more northern parts of the zone. This means that in colonies wintered outdoors the bees are compelled to overcome this degree of cold at all times during the coldest part of the winter. If they are so well packed that the heat which they generate is lost slowly, they are able to generate sufficient heat to make the interior of the hive warm enough to allow them to break their cluster as is necessary. In zone 2, however, the bees will be compelled to generate heat sufficient to overcome the more severe cold of that zone, and this calls for the expenditure by the bees of so much more food and vitality that it is more economical to put them in a good cellar during the months of the most severe cold, and cellar wintering is therefore preferable.

CHARACTER OF WINTER STORES.

In localities where the stores for the bees gathered during the latter part of the summer are not of the first quality, it is safer to winter

[1] Department Bulletin 93, The Temperature of the Honeybee Cluster in Winter. Farmers' Bulletin 695, Outdoor Wintering of Bees.

[2] Farmers' Bulletin 1012, Preparation of Bees for Outdoor Wintering.

the bees outdoors. This is a large factor in the placing of the zones shown in figure 1, for it is quite common in the region south of zone 1 for the fall honey to be of inferior quality. It is extremely fortunate that in both of the zones shown the stores available in winter are usually of the finest quality. As will be shown later, it is highly important that the beekeeper pay special attention to the character of the stores in the hive at the beginning of the winter, and if they are not as good as they should be, this deficiency should be corrected.

LOCATION AS REGARDS WIND PROTECTION.

In zone 1, if the apiary is so badly located that the winter winds are severe, the beekeeper will do well to winter in a cellar, although, as will be shown later, it is not best to choose such a site for the apiary even during the rest of the year.

ESSENTIALS TO SUCCESS.

As in the case of outdoor wintering, the essentials to success in caring for a normal colony of bees from the end of one season's honey-flow to the beginning of the next lie in providing three things in abundance: (1) Stores of good quality, (2) protection from wind and cold, and (3) room for the rearing of brood at appropriate times. These factors must not be lacking at the right times, and if any one is omitted it may prevent the bees from gathering the crop of the following season. These three factors do not apply equally throughout the period of relative inactivity, but as certainly as any one of them is decreased, just so certainly will the crop of the following year be reduced.

In practicing cellar wintering it is unnecessary to leave so much honey with the bees during the time that they are in the cellar, and it is not necessary during that period to leave room for the rearing of brood. During the coldest part of the winter the bees need especially protection from cold and wind, although enough good stores must be in the hive to keep them through that period in good condition. Probably a large part of the failure of beekeepers in practicing cellar wintering comes from the fact that before and after the bees are in the cellar the important factors of stores and breeding room have not been adequately supplied. Before the bees are put into the cellar they must have room for breeding and stores in abundance, and after they are taken out these two factors must be present in greatly increased abundance.

NECESSITY OF STRONG COLONIES IN THE FALL.

As in the case of wintering outdoors, it is wasteful to attempt to winter weak colonies. It is difficult to set standards of colony strength at this season, but it is unwise to attempt to winter colonies

that are not strong enough to have brood sufficient to fill three or four Langstroth frames two months before the first killing frost. If the colonies in the apiary are not of the proper strength, it is wise to unite until the proper strength is reached. Any uniting should be done before the close of brood-rearing.

It is of the greatest importance that every colony have a good queen in order that brood-rearing may continue in the fall and may then again proceed rapidly in the spring. Usually it is best to requeen at least every two years, but if good wintering is practiced the colonies will come out of winter quarters so strong and will build up so rapidly in the spring that the queens will soon wear out, making it safer to requeen every year. To get the best results from requeening, all young queens should be introduced so that they begin to lay about two months before the first killing frost.

WINTER STORES.

The stores given to the bees from the end of one season to the beginning of the next are of the first importance. It is necessary to consider both the quality and the quantity of these stores.

QUALITY OF STORES.

As has been stated, it is fortunate that in both of the zones where cellar wintering is or might be practiced the natural stores usually are good. Honeys such as those from white and alsike clovers, sweet clover, alfalfa, wild raspberry, buckwheat, and willowherb are fine stores for winter, while honeys from basswood, heartsease (smartweed), asters, goldenrod, and most of the other fall flowers are less desirable. It is especially important during the period when the bees are in the cellar that the stores shall be of the very finest quality, and it is therefore the practice of many good beekeepers to feed each colony 5 pounds or more of sirup made of granulated sugar late in the fall, after all brood-rearing has ceased. This insures that the bees will have for their use, during the period of confinement in the cellar, stores which will not bring about the condition known as dysentery. In general it may be stated that honeys from mixed sources and dark honeys, except buckwheat, are to be avoided. Honeydew honeys are highly injurious and in all cases where such stores are present granulated sugar sirup should be fed.

QUANTITY OF STORES.

From the end of one honey season to the beginning of the next a good colony of bees will need fully 45 pounds of honey. When the bees are wintered in the cellar, it is usual not to have all of this honey in the one hive body in which they are wintered. It is a good practice to have at least 20 pounds within this hive, although 15 pounds

will be safe. It is absolutely imperative, however, that the remainder of the 45 pounds shall be available to be given to the bees soon after they are taken from the cellar. The most common cause of poor colonies in the spring is poverty, directly due to neglect on the part of the beekeeper. A good beekeeper sees to it that at no time when brood is being reared do his bees have less than 15 pounds of stores in the hive, and the full amount of 45 pounds often will all be used, and is always needed if the colonies are to come to full strength on time for the gathering of the full crop. This amount is always augmented by honey from spring flowers, for 45 pounds of honey is not enough to bring a colony to full strength in time for the main honey-flow.

ARRANGEMENT OF THE APIARY.

Where bees are wintered in cellars the particular arrangement of the hives in the apiary is not so important a problem as where they are wintered on their summer stands, yet there are certain important considerations in the arrangement of the entire apiary which should be kept in mind.

WIND PROTECTION.

It is important that a place be chosen where the bees will be protected from cold winds in the spring after they are taken from the cellar and again in the fall before they are taken to the cellar. A grove of trees or an adjacent hill usually offers the best protection, or it is possible to make an artificial windbreak such as a high fence. A natural windbreak usually is better, for it is more extensive in most cases. Too much reliance should not be placed in buildings, for often they merely divert the wind slightly and may make conditions worse. A fence made of close boards usually is unsatisfactory, for it causes whirls.

DISTANCE OF THE APIARY FROM THE CELLAR.

To carry colonies of bees a long distance from the apiary to the cellar is not an easy task, even though the hives be light at that time of the year. It is best, therefore, that the apiary be located not more than 50 yards from the cellar, and even this distance is objectionable. If a special cellar is built for the bees, the apiary should be so located that the cellar may be built immediately adjacent. If the bees are to be wintered in the cellar under the beekeeper's residence, the apiary should be located as near as possible to the cellar door.

THE BEE CELLAR.

In order that the beekeeper may have reason to expect success in cellar wintering, it is imperative that he give careful consideration to the construction of the bee cellar. There has been a tendency among

beekeepers greatly to overestimate the value of their own cellars, and especially to assume that the conditions which they are able to get in their cellars are exactly correct.

CELLAR UNDER THE RESIDENCE.

Some of the best bee cellars are those under the residences of beekeepers, and in general such a cellar is better than one built especially for cellar wintering. This is because the temperature of such a cellar usually is quite a little higher than that in a specially constructed repository. The best results in cellar wintering have been obtained in cellars under residences which are heated by furnaces, thus having a higher cellar temperature. In such a cellar provision must be made for partitioning off a space where the bees will be located so that there is no light or other disturbing factor during the time of their confinement. Since a cellar temperature about 50° F. is desirable, it is well to choose a part of the cellar through which some of the furnace pipes run, and if this results in too high a temperature these pipes may be insulated somewhat. It is best to choose a part of the cellar where there are no windows and where the outside walls are thoroughly protected to the top, either by a bank of soil or in some other fashion. This will result in a more equable temperature than is possible in a cellar exposed to sudden changes of temperature on the outside walls, for even a stone wall 18 inches thick will allow a considerable amount of heat to escape. In a cellar under a residence there will be abundant ventilation without any special provision being made for this. A test of the value of such a cellar is the even temperature which may be obtained, as will be discussed later.

SPECIAL WINTER REPOSITORY.

If properly constructed and protected, a special cellar or cave for the bees gives the best possible results in wintering, yet few such cellars have been built, for the reason that most beekeepers have omitted some vitally important factors. The usual fault is in having too great a variation in temperature and in giving excessive ventilation, which in turn causes fluctuations in temperature.

SOIL AND CONTOUR OF THE SURFACE OF THE GROUND.

To provide good drainage and adequate ventilation for the bee cellar without making any special ventilators, it is desirable to build it in a sandy hillside. If it is possible to choose a place for the cellar where the snow drifts deeply, this will afford a valuable addition to the insulation of the cellar. If the cellar is on level ground, drifting of snow may be increased by the proper building of open fences, such as are used to prevent drifting over railway tracks.

If it is impossible to utilize a sandy hillside, it will be necessary to build walls and a floor for the cellar and to make adequate provision for the drainage of the cellar. The hillside cellar has the great advantage of having easy drainage.

CAPACITY OF THE CELLAR.

If the bees are kept in apiaries of perhaps 100 colonies and if a cellar is built for each apiary, then it is possible to build a cellar of just the right capacity. If a central cellar is built for all the apiaries and the bees in outapiaries are brought into the home apiary for winter, the beekeeper will wish to build the cellar sufficiently large for future expansion of his business, and beekeepers are finding out

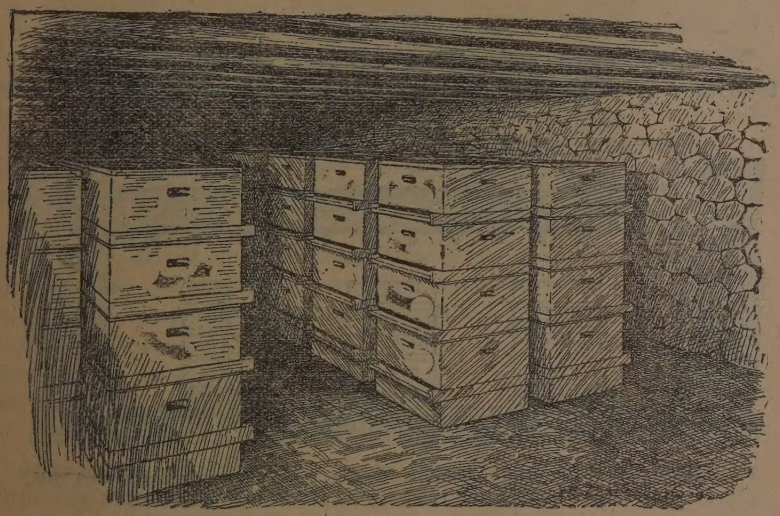

FIG. 2.—Interior of bee cellar with hives in piles of four. Insulation above the ceiling is not shown.

that they can keep many more colonies of bees than they formerly thought possible. Perhaps the better plan is to have a cellar in each apiary.

The usual practice is to allow 1½ to 2 square feet of floor surface for each colony, on the assumption that the colonies will be placed in piles of four (fig. 2). It is not desirable to pile hives higher than this, if the cellar roof is 6½ feet high in the clear, and it is difficult to lift heavy hives any higher than the number specified. For an apiary of 100 colonies, it will be found desirable to have a cellar 10 feet wide and from 15 to 20 feet long, clear of the inner walls. If one is just getting a start in beekeeping he should build his cellar on the assumption that later he will increase the number of his colo-

nies, and should allow for this, for it is better to have the cellar too large than too small.

WALLS AND FLOOR.

It has been claimed by many beekeepers that concrete walls and floor are not desirable, yet if the cellar is properly insulated there is no better material. If the cellar is built in a hillside of sandy soil, wooden sides will be satisfactory and no floor other than the soil need be provided. In such soil the drainage is good and the only function of the side walls is to hold the sides up to prevent caving in. In a moist soil a concrete floor and walls should be built, and the concrete should be waterproof. Under no circumstances should any of the side walls below the ceiling be exposed above ground.

ROOF.

The ceiling of the cellar should be below ground level sufficiently to bring it below the level of frost. For the regions where bees should

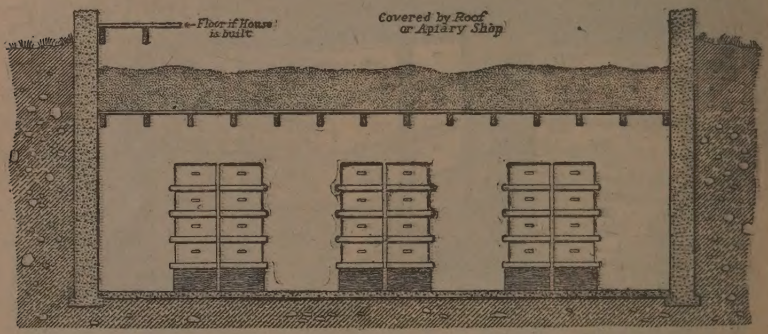

FIG. 3.—Diagram of bee cellar. Clearance 6½ feet, ceiling 2½ feet below ground level, packed with about 1½ feet of sawdust.

be wintered in cellars this usually will be at least 2½ feet below the level of the ground (fig. 3). The ceiling should be 6½ feet above the floor, just sufficiently high to permit a tall man to work with comfort. If the ceiling is higher it will result usually in too low a temperature at the floor. The ceiling then should be covered completely on top with some insulating material, such as sawdust, and if sawdust is used it should be piled on about 1½ feet thick. Unless about this amount of protection is given on the ceiling it will be impossible to get the right cellar temperature during the coldest part of the winter. If the cellar is built in a sandy soil, it is possible to use the soil as a cover for the ceiling, in which event about 3 feet of soil should be placed over the inner roof of the cellar. The entire insulating material, of whatever kind used, should then be protected from rain and snow by having a roof over it. This roof should project at least 2

feet, preferably more, beyond the outside of the cellar wall, and provision should be made for carrying off the water from the roof.

In case the beekeeper desires to build an apiary house over the bee cellar, as is done frequently, he must provide a floor for this house at least at ground level, and he can not successfully use the ceiling of the cellar as the floor of the upper house. There is no objection to building a house above the cellar if adequate protection is given the cellar, but it must not be assumed that the house offers any material insulation to the cellar, for in most cases these houses are not heated in the winter. The relation of the house floor to the ceiling of the cellar is shown in figure 3.

ENTRANCE TO THE CELLAR.

Frequently the entrance is a weak spot in the insulation of the cellar, and it is useless to protect the roof and sides unless care is used in the building of the entrance. If the entrance is at the end or one side of the cellar, it will be necessary to build a sort of vestibule with double doors so that the heat of the cellar will not be lost rapidly. The heavier and thicker these doors, the better for the bees.

The best type of vestibule is a long, narrow passage leading into the hillside, and it should be closed by doors at both the inside and outside ends. If possible the vestibule should be built and protected so that the temperature within the vestibule will never fall below freezing. In the building of the vestibule, also, the beekeeper should consider the ease with which the bees may be carried in and out of the cellar.

DRAINAGE.

As has been mentioned previously, the cellar must be well drained, either by natural or by artificial means. No stagnant water should be allowed to remain in the cellar, although at the higher temperatures of the best cellars this does less harm than it does in cellars that are too cold. Some beekeepers have advocated having a stream of water flowing through the cellar, and this will do no harm in warm cellars, and it may serve to assist somewhat in maintaining an even tempertaure.

VENTILATORS.

One of the most serious faults of bee cellars is in providing for too much ventilation, resulting in great fluctuations in temperature. In a cellar which maintains a temperature of 50° F. or more there is little need for ventilation, for the bees then need little oxygen and only a small amount of carbon dioxide is given off. Other things being equal, the colder the cellar, the greater the need of ventilation. If poor stores are in the hives, the bees will need more ventilation

than will be desirable when good stores are used. In a warm cellar in a sandy hillside no ventilating shaft need be built.

In any event, one shaft 6 inches square running through the ceiling of the cellar to the outside will be sufficient for any cellar that is fit for the wintering of bees. During the coldest part of the winter the interchange of air between the inside of the cellar and the outside will be materially increased by the great difference in temperature and this one ventilator may be entirely or nearly closed. During the milder weather of the fall and spring this amount of ventilation will do no harm. The top of the ventilating shaft, which should extend at least 6 feet above the outer roof, may be painted black in order to induce greater movement of air when the sun shines. The shaft should be so arranged that it does not admit light to the cellar.

PUTTING THE BEES INTO THE CELLAR.

Before the bees are carried into the cellar it should be well aired and cleaned, and it will be well to keep it open for several days beforehand. No débris or refuse should be left in the cellar when the bees are taken in.

TIME.

For zone 1 (fig. 1) it is usually desirable to wait until about the middle of November before putting the bees into winter quarters. If one could know exactly when the bees would have the last opportunity for a cleansing flight, they would be put into the cellar just after that, but we can not always be sure that there will be suitable weather for such flight in late November, and there is, therefore, considerable doubt every year as to just the right time to put the bees away. Frequently it happens that the weather is suitable for a flight about November 20, and it is best to wait until then before attempting to put the bees in the cellar. The flight of only a few bees from the hive should not be construed as a cleansing flight. In this connection it is highly desirable that the beekeeper keep a careful watch of the weather maps daily, so that he may know at all times about what weather may be expected for a few days in advance. For the beekeeper's purpose the daily forecasts published in newspapers are scarcely enough; and if no daily weather maps are convenient near by, it will repay the beekeeper well to subscribe for them. They are valuable not only at the time of putting the bees into the cellar but at many other times of the year.

Soon after a period when the barometric pressure has been low, bringing high temperatures suitable for flights (at least 60° F.), there usually will be a period when the barometric pressure is high, bringing lower temperatures. At the shifting from low to high barometric pressure there is frequently a time when it is cloudy.

This is a fine time to put the bees into the cellar. These periods of high and low barometric pressure follow each other with rather marked regularity in the fall, and it is rather safe to assume that just at the end of the well-defined low pressure which next follows after November 15 is the best time to put the bees into the cellar. It is better to put the bees in the cellar a week or so before the last opportunity for flight than to put them in after exposure to cold which is not followed by a cleansing flight.

For zone 2 it will be desirable to put the bees away a little earlier, although the oncoming of winter is not so much earlier in the North as one might imagine.

HOW TO CARRY THE BEES.

When one person carries the bees into the cellar the best method is to stand at the back of the hive and grasp the bottom of the hive with both hands. The hive is then lifted and the cover brought up against the chest firmly, permitting the operator to walk without interference and with a minimum of stooping. If there are cleats on the ends of the hive bodies, these may be rested on the forearms, although with this method there is some danger that the bottoms will drop off unless they are stapled.

If the temperature is sufficiently low (slightly above freezing), there will be no need of closing the entrances when the bees are being carried in. Every care should be taken not to jar the hives more than is absolutely necessary from the time that they are lifted until they are in their final place in the cellar.

If more than one person is engaged in carrying in the hives, the hives may be placed carefully on carriers with handles, and two or more of them may be carried at one time.

HOW TO STACK THE HIVES.

The bottom hive in a pile should rest on an empty hive body or some other such support of about that size (figs. 2 and 3). The hives then should be placed one on top of the other until they are four high. It is best by far to put each pile of four hives about 6 inches from adjacent piles, so that in handling the hives on one pile there is no disturbance of bees in other piles. Allowance is made for this space between the piles of hives in the estimate of the floor space needed for each colony (p. 9).

MAINTENANCE OF THE CELLAR DURING THE WINTER.

If the cellar is properly constructed it will need little if any care during the time that the bees are inside. It is only the poor bee cellar which requires constant attention to prevent changes in temperature.

TEMPERATURE OF THE CELLAR.

There has been much discussion as to the best temperature of the cellar during the winter. Commonly it is stated that a temperature of 40° to 45° F. is best, but this is colder than usually is best for the finest results. A temperature below 40° F. is invariably bad for the bees, and a cellar in which the temperature goes as low as freezing is not a fit place for bees.

It has been found by the authors that bees do the least amount of work when the temperature of the air immediately surrounding them (inside the hive) stands at 57° F. This is, therefore, the temperature which the beekeeper should bear in mind, rather than to lay too much stress on the temperature of the cellar itself. The place for a thermometer in the bee cellar is inside the entrance of a good colony where it may be read easily by simply pulling it out. A chemical thermometer is best for this purpose, and it should register 52° F. or more inside the hive entrance. In order to have the right temperature within the hive it usually will be best to have the temperature of the cellar at about 50° F. or slightly higher. As will be shown later, however, it is quite possible to have the right temperature within the hive when the temperature of the cellar is a few degrees lower than that stated.

If the beekeeper will pay attention to the temperature of the interior of the hive he will find that in colder cellars it is desirable to give the hives some insulation to conserve the heat generated by the bees in much the same way that this heat is conserved when bees are packed outdoors, although the amount of protection will be much less. In a cellar where the temperature falls to 45° F. it will be found best to have the covers of the hives sealed on tightly and the entrances reduced to $\frac{3}{8}$ inch by 2 inches. In a cellar with a temperature of 50° F. or more the entrances may be left open the full width of the hive. If there is a tendency for the temperature to fall to 45° F. or less, the tops of the hives may be protected by cushions of chaff or other materials placed at least on the top of the uppermost hives, for each of the lower three hives is protected somewhat by the one above it.

It will be impossible to maintain the temperatures recommended unless the cellar is built in the way described, or in some other way by which the cellar is equally well insulated. It is impossible to maintain an equable and high temperature in a cellar the walls and ceiling of which are exposed to the outside air.

VENTILATION OF THE CELLAR.

If the proper temperature is maintained in the cellar there will be little need of ventilation, for in almost all cases there will be sufficient interchange of air to keep the bees in good condition.

If the temperature is as low as 45° F., a little ventilation will be needed, although most of the bee cellars that have been built have had too much ventilation, and as a result it has been impossible to maintain a correct temperature within them. In cold weather the tendency toward an interchange of air is greatest, and at such times the ventilators may be entirely closed. In mild weather it makes no difference if large ventilators are open, unless this results in too great a rise in temperature.

In a well-insulated cellar it should not be necessary to ventilate at night at the approach of spring to cool the air inside, for the bees will not get so warm from their own activity as will bees in a cellar that is or has been too cold. The greatest problem in most cellars is to maintain the right temperature during the spring just before the bees are to be removed. The trouble is that in most cellars—those which are too cold in winter—the bees generate heat constantly during the winter and as a result have an accumulation of feces in the intestines, resulting in a condition known as dysentery. For this reason they become excited easily, and beekeepers have thought it necessary to ventilate the cellar at night freely in order to remedy this trouble. The proper method, of course, is to prevent it by keeping the temperature higher during the winter, but if the temperature has fallen too low during the winter ventilation at night seems to help somewhat. It is safe, however, to say that a cellar in which this happens is not satisfactory as a place to keep bees during the winter, and steps should be taken to insulate it more completely before bees are put into it again. If the bees are wintering on stores that are not of the best quality the tendency to accumulate feces will be far greater, even with the right temperatures inside the hives, and if there is dysentery it may be relieved somewhat by ventilation, although this is simply reducing a symptom and is not removing the cause of the trouble.

VENTILATION OF THE HIVE.

Since bees in a good cellar require little ventilation, practically no attention need be paid to this subject if the cellar has been built in the way advised. If the temperature of the cellar tends to fall too low, it is advisable to reduce the entrances of the hives, for with a greater difference between the temperatures within and outside the hive the tendency for interchange of air will be correspondingly greater. In any cellar fit for the wintering of bees it will be neither necessary nor desirable to ventilate the hives at the top, as sometimes has been recommended.

The ventilation of the hive within the cellar is not so much for the elimination of foul air as for the escape of moisture, and therefore the amount of ventilation needed for the hive depends upon

the humidity of the air within the cellar. If the temperature of the cellar is kept high enough there will be no condensation of moisture within the hive, and if water is ever observed on the covers of the hives it is conclusive proof that the cellar is too cold for the bees. In a cellar so cold that condensed moisture shows on the bottoms of the hives steps should be taken at once to raise the temperature.

Various attempts have been made in the past to provide for the cellar fresh air which has been warmed somewhat before entry. The most common method is to have the air pass through tiles under ground for perhaps 100 feet before it enters the cellar. In general, it may be said that none of these devices has been worth the trouble and expense involved and none of them has served the purpose for which it was intended. It has been proposed also to ventilate the bee cellar by wind pressure. The devices which have been made for such ventilation will function only when there is considerable wind and then only when the wind is in the right quarter; therefore they are not at all to be recommended. By far the best plan is simply to build the bee cellar correctly, for then little ventilation will be needed.

CLEANING THE CELLAR.

In even the best of cellars there will be some dead bees on the floor, and these may be cleaned up once or twice during the winter. In a cellar with proper temperature there will be few dead bees until after the middle of the winter, but the death rate increases toward the close of the winter. If the cellar is cleaned, it should be done with as little disturbance as possible. No bright light should be admitted at this time, although a moderate amount seems to do little harm until after the bees have an accumulation of feces in the intestines.

REMOVING THE BEES FOR FLIGHT DURING THE WINTER.

Some beekeepers have advocated removing the colonies toward the end of the winter for a flight on some warm day and then replacing them, on the supposition that the flight would enable the bees to stand a longer period of confinement. It is found, however, that if bees are disturbed, as by carrying them out, they begin brood-rearing almost invariably, and this does more harm than the flight does good.

DISTURBANCE DURING THE WINTER.

Work in or about the bee cellar while the bees are confined should be done with the least possible disturbance of the bees, for often a little handling or jarring of the hive causes sufficient excitement to increase the temperature of the cluster to the point where brood-rearing begins. This is true especially in late winter. It is by far the

wisest plan, therefore, to stay out of the cellar during the winter, except on the few occasions when a little work, such as cleaning out, makes a visit seem needed. Care should be taken not to jar the hives or to allow light to strike the entrance. Of course, if bees are being wintered in a cellar which has the right temperature, a little disturbance does little or no harm, but there is no reason why bees should be disturbed in winter and the beekeeper should not run any risk of starting brood-rearing.

REMOVAL OF THE BEES FROM THE CELLAR.

TIME.

The old rule of many beekeepers is to take the bees from the cellar when the soft maples are in bloom. This is an excellent rule in localities where there are trees of this species. In general, in zone 1 the right time to take the bees out of the cellar is about the time of the spring equinox (March 21).

In choosing a time for the removal of the bees, the beekeeper again should watch the weather maps closely. He should choose a time when a high-pressure area is just passing and at the approach of a well-defined low-pressure area. At such a time the weather will be cool, not permitting the bees to fly, but at the time of the low-pressure area the weather will become warmer, allowing the good flights, which are then badly needed.

If the bees are taken out at a time when they can fly at once—and some beekeepers prefer this—they should be taken out in the early morning, so that they can have a good flight before night. Bees should not be taken from the cellar at a time when they can fly only a little, but they should either be taken out when they can not fly at all or at a time when they can fly freely almost at once. Bees in good condition rarely fly freely unless the outside temperature is as high as 60° F.

PREVENTION OF DRIFTING.

When the bees are taken from the cellar and placed on their summer positions they sometimes tend to leave the weaker colonies and on their return to collect in those with greater populations. This is known as "drifting." In general, the bees tend to drift toward the windward side of the apiary. Most frequently they join the hives that were first set out and which have established a strong flight by the time the neighboring colonies have first taken wing. The tendencies, therefore, are to join flying colonies, stronger colonies, and the end colonies in a row. The condition of the bees plays a large part in drifting, for if the bees are badly in need of a flight because of dysentery they go at once into the air without properly marking the location of their hive, and therefore are not able to find it when they return.

To prevent drifting, it is best to set the bees out when it is too cold for them to fly, so that as the weather warms, permitting flight, this will take place more naturally. It is also well to reduce the entrances so that as the bees leave the hive their tendency to orient themselves will be greater. It is claimed by some beekeepers that if the cellar is well aired the night before the bees are to be removed, they will be in better condition and will drift less, but it is not clear what difference this can make unless the clusters are made tighter because of lower temperatures.

Beekeepers have discussed the question whether, after removal, the bees should be placed on the same stands occupied by them the fall before. If the bees could remember their old location so that they would return to it, even after an interval of four months, it would be necessary, or at least desirable, to place each colony on the same stand which it occupied previously. There is no evidence, however, that the memory of the bees is so good, and it is usually the case that the bees of a colony will lose the memory of location within a week; therefore no attention need be paid to this feature.

PROTECTION OF THE HIVES IN THE SPRING.

The greatest objection to wintering bees in cellars is that after they are removed they are exposed to low temperatures. The ideal practice would be to pack the bees after taking them out in much the same way that bees are packed for outdoor wintering, but the work involved makes this impracticable. There can be no doubt that protection at this time would be beneficial. As has been pointed out, the apiary site should be one in which the hives are well protected from wind, and it is advantageous if the apiary grounds slope toward the south in order that the bees may have the fullest advantage of heat from the sun. If the bees have been wintered in the cellar in double-walled hives they will have the advantage of some protection when they are taken from the cellar. The beekeeper may feel safe in giving the bees all the protection possible at the time that they are taken from the cellar, knowing that it is impossible at this time or any other to insulate the hive too well.

In deciding whether the hives should be packed in the spring the beekeeper should be governed largely by the condition of the bees. If they have wintered well they will be able to stand greater extremes of temperature in the spring without loss, but if they have been wintered in a cold cellar they will be greatly injured by cold weather after they have been set out. Of course, the need of protection is determined chiefly by the kind of weather prevailing during the first few weeks after the bees have been taken from the cellar. In some seasons the weather is so fine that the bees would be little benefited by packing or other protection, but the beekeeper can not

influence the weather, and the only safe plan is so to place the bees that if the weather does turn cold they will still be safe. Here, as everywhere else in beekeeping, it pays to be on the safe side, so far as protecting the bees is concerned.

PROVIDING BREEDING ROOM AND STORES IN THE SPRING.

After the main honey-flow is past it is usually desirable that each colony be kept in two hive bodies of full depth. Most producers of extracted honey do this, but too many producers of comb-honey are not adequately supplied with hive bodies and do not give the second body. These two hive bodies should be left with the bees at least until brood-rearing ceases, and at this time one of them should be removed if the bees are to be wintered in the cellar. As has been pointed out in other bulletins of the department, if the bees are wintered outdoors they will do better in the two hive bodies throughout the winter.

In the upper hive body will be found a considerable amount of the honey to be used by the bees up to the time of the next honey-flow. Usually there will be enough in the lower hive body for the bees while they are in the cellar, especially where comb-honey is produced, but if the lower hive body is not adequately supplied with winter stores (perhaps 15 to 20 pounds) the beekeeper should move some of the stores. It is also a good practice to winter the bees in the cellar in a hive containing the full stores, except that this makes it necessary to carry in hives weighing perhaps 80 pounds.

After the second hive bodies have been removed, if they contain honey they should be stored in a warm, dry place, where the honey will not be injured. If it is possible to place such hive bodies in the furnace room of the residence, this will be found to be ideal. If no such place is available, the beekeeper may keep these in a dry cellar or other location where the honey will not be exposed to rapid changes in temperature. For this purpose a place suitable for the storage of comb-honey is desirable. It should be pointed out that the honey in these combs should not be extracted. It will be needed for the building up of the colonies the next spring, and to remove it is simply to reduce the crop of the next season.

Some time within two weeks after the bees have been taken from the cellar, depending on the weather, each colony should be provided with its second hive body. Preferably, this should be placed underneath the hive body in which the bees were wintered in order that the propolis at the top of the hive may not be broken. At this time an examination of the colonies may be made from below to see whether any of them are queenless or require immediate attention for other reasons, but at this season there is little that the beekeeper can do that will help the bees other than to provide them

with room for the brood and with adequate supplies of stores. Queens should not be clipped at this time, and usually not until settled weather has arrived. Further spring manipulation is not necessary and the bees are better off if the beekeeper lets them alone.

If the bees have been requeened at the proper time and if the total amount of stores is given as indicated, it will not be worth while to go through the bees to look for queenless colonies. The beekeeper should see to it that at least 45 pounds of honey are provided for each colony from the time of the last honey-flow in the fall to the beginning of the first main honey-flow of the following season. If this is not given in full, the beekeeper may be sure that the crop of the following year will be reduced. This amount of honey left for the use of the bees is a better investment for the beekeeper than money in the bank.

It should be pointed out that the giving of a second hive body in the spring is not simply a means of supplying additional stores, but more than one hive body will be needed for the development of the brood. A single 10-frame Langstroth hive is not large enough for the development of a good colony of bees, which, before the beginning of the main honey flow, should have brood to fill at least 12 frames.

As was stated earlier in this bulletin, a colony of bees from one season to the next needs three things in abundance—room for the development of the brood, stores of good quality, and protection from wind and cold. In cellar wintering the protection is given by putting the bees in the cellar; the room and stores must be supplied later or the population of the colony will be reduced at the critical time of the honey-flow. If the early sources of honey are abundant, the amount of honey advised will not be consumed. The wise beekeeper, however, does not gamble on the early honey-flows, but invests this honey as life insurance for his bees.

MEASURES OF SUCCESS IN CELLAR WINTERING.

It is often difficult for the beekeeper to know whether his bee cellar is giving the best results, for he may not have been able to determine from reading or the observation of other cellars whether it is satisfactory. The writers, therefore, have attempted below to give a few measures which the beekeeper may apply to his apiary and his cellar, so that he may be able to decide whether his methods of cellar wintering should be improved.

(1) During the winter a thermometer inserted in the entrance of the hive should show a temperature of at least 52° F.

(2) There should never be any condensed moisture on the covers of the hives, and certainly never any on the bottoms.

(3) While the cellar should be kept dark at all times, if a candle is held at the entrance of a hive at the end of January it should be several seconds before any of the bees break cluster. Frequently the cellar doors may be opened in March without disturbing the bees.

(4) There should never be many dead bees on the bottom of the hives. The live bees should be able to push them out as they die during the winter. The bees thus carried out will be found on the cellar floor just below the entrances. If there are bees all over the floor, it shows that these bees have flown from the hives— an indication of poor wintering.

(5) The bees should be quiet during the late winter. Noise at this time indicates that the bees are disturbed by an accumulation of feces, caused by low temperatures or poor food.

(6) If the bees were in good condition in the fall and have been wintered well, the loss during the winter will never be more than one-sixth of the total population of the hive. Such a loss is excessive, however, and in a well-wintered colony it may be as low as a hundred bees. This probably depends to a large extent on the age of the bees which go into winter, and if the temperature is right and the stores good there will be almost no loss of vigorous bees.

(7) The bees should not leave the hive while they are being carried from the cellar. If they do, it indicates that they are excited by an accumulation of feces.

(8) Before removal from the cellar there should be no spotting of the hives from dysentery. There may be a little spotting after the bees have had a free flight outside, but if this is small in amount it does not indicate a serious condition.

(9) When the bees are taken from the cellar there should be no moldy combs, for the cellar at the right temperature will be too dry for the growth of molds.

(10) There should be no brood when the colonies are taken from the cellar. Brood-rearing in the cellar is proof that the cellar is too cold or that the food used by the bees is inferior.

(11) Enough brood should be in each colony at the opening of the main honey-flow to fill completely 12 Langstroth frames.

(12) The population of the hive should not decrease appreciably after the bees are removed from the cellar. Such a condition, known as spring dwindling, is an indication of poor wintering. For three weeks after the hives are set out no new bees will be emerging, but the loss of bees during this time should be so small as not to be noticeable.

THE PRESIDENT TO THE FARMERS OF AMERICA.

[Extracts from President Wilson's message to the Farmers' Conference at Urbana, Ill., January 31, 1918.]

The forces that fight for freedom, the freedom of men all over the world as well as our own, depend upon us in an extraordinary and unexpected degree for sustenance, for the supply of the materials by which men are to live and to fight, and it will be our glory when the war is over that we have supplied those materials and supplied them abundantly, and it will be all the more glory because in supplying them we have made our supreme effort and sacrifice.

In the field of agriculture we have agencies and instrumentalities, fortunately, such as no other government in the world can show. The Department of Agriculture is undoubtedly the greatest practical and scientific agricultural organization in the world. Its total annual budget of $46,000,000 has been increased during the last four years more than 72 per cent. It has a staff of 18,000, including a large number of highly trained experts, and alongside of it stands the unique land grant colleges, which are without example elsewhere, and the 69 State and Federal experiment stations. These colleges and experiment stations have a total endowment of plant and equipment of $172,000,000 and an income of more than $35,000,000 with 10,271 teachers, a resident student body of 125,000, and a vast additional number receiving instructions at their homes. County agents, joint officers of the Department of Agriculture and of the colleges, are everywhere cooperating with the farmers and assiting them. The number of extension workers under the Smith-Lever Act and under the recent emergency legislation has grown to 5,500 men and women working regularly in the various communities and taking to the farmer the latest scientific and practical information. Alongside these great public agencies stand the very effective voluntary organizationsamong the farmers themselves which are more and more learning the best methods of cooperation and the best methods of putting to practical use the assistance derived from governmental sources. The banking legislation of the last two or three years has given the farmers access to the great lendable capital of the country, and it has become the duty both of the men in charge of the Federal Reserve Banking System and of the Farm Loan Banking System to see to it that the farmers obtain the credit, both short term and long term, to which they are entitled not only, but which it is imperatively necessary should be extended to them if the present tasks of the country are to be adequately performed. Both by direct purchase of nitrates and by the establishment of plants to produce nitrates, the Government is doing its utmost to assist in

the problem of fertilization. The Department of Agriculture and other agencies are actively assisting the farmers to locate, safeguard, and secure at cost an adequate supply of sound seed.

The farmers of this country are as efficient as any other farmers in the world. They do not produce more per acre than the farmers in Europe. It is not necessary that they should do so. It would perhaps be bad economy for them to attempt it. But they do produce by two to three or four times more per man, per unit of labor and capital, than the farmers of any European country. They are more alert and use more labor-saving devices than any other farmers in the world. And their response to the demands of the present emergency has been in every way remarkable. Last spring their planting exceeded by 12,000,000 acres the largest planting of any previous year, and the yields from the crops were record-breaking yields. In the fall of 1917 a wheat acreage of 42,170,000 was planted, which was 1,000,000 larger than for any preceding year, 3,000,000 greater than the next largest, and 7,000,000 greater than the preceding five-year average.

But I ought to say to you that it is not only necessary that these achievements should be repeated, but that they should be exceeded. I know what this advice involves. It involves not only labor but sacrifice, the painstaking application of every bit of scientific knowledge and every tested practice that is available. It means the utmost economy, even to the point where the pinch comes. It means the kind of concentration and self-sacrifice which is involved in the field of battle itself, where the object always looms greater than the individual. And yet the Government will help and help in every way that it is possible.

It was farmers from whom came the first shots at Lexington, that set aflame the Revolution that made America free. I hope and believe that the farmers of America will willingly and conspicuously stand by to win this war also. The toil, the intelligence, the energy, the foresight, the self-sacrifice, and devotion of the farmers of America will, I believe, bring to a triumphant conclusion this great last war for the emancipation of men from the control of arbitrary government and the selfishness of class legislation and control, and then, when the end has come, we may look each other in the face and be glad that we are Americans and have had the privilege to play such a part.

THE BUSINESS OF AGRICULTURE.

[Extracts from addresses.]

The next great factor to enlist for the betterment of Agriculture and rural life in this Nation is the business man of the town and the city. He has not always been alive to his obligations. He has contented himself, in too many instances, with plans to secure profit in agricultural trade, instead of sympathetically and eagerly planning constructive assistance. This duty, pressing in peace time, is of the most urgent and impelling character in this crisis; and I appeal to the bankers and business men to see that they omit no effort to familiarize themselves with the agencies serving to aid the farmers and to promote wise plans to secure the necessary results.

D. F. HOUSTON,
Secretary of Agriculture.

In the interest of our national development at all times and in the interest of war efficiency just now our agriculture must be well maintained. It should be remembered that the agricultural unit is a small unit. There are 6,000,000 farms in this country, each an individual unit. It is to the interest of persons who do not live on farms, even more than to the interest of those who do live on farms, that production shall be kept up. This means that all people, not farmers alone, but those who live in cities as well as the farmers, are interested in experimental and educational activities along agricultural lines as conducted by the Federal Government and the States. These efforts should be liberally supported.

R. A. PEARSON,
Assistant Secretary of Agriculture.

In a time like this no man has a moral right, whatever his fortune may be, to employ another man to render any service of mere comfort or convenience. When the finest young men of the United States are in France digging ditches, sawing lumber, laying rails, and playing with death, and when the finest young women of the United States are scrubbing floors in hospitals, it is a sin that almost approaches the unpardonable offense against civilization for any man or women in the United States to engage in a wasteful or unnecessary service.

CLARENCE OUSLEY,
Assistant Secretary of Agriculture.

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